



Revision of the Chinese species of the leafhopper genus *Dayus* Mahmood (Hemiptera: Cicadellidae: Typhlocybinae: Empoascini), with description of three new species

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Abstract

The Chinese species of the typhlocybinae genus *Dayus* Mahmood are revised. A total of five species, including three new species—*lii* n.sp., *lamellatus* n.sp. and *membranaceus* n.sp. from Fujian Province are described, and a key to Chinese *Dayus* species is included.

Key words: Homoptera, morphology, distribution, identification, taxonomy

Introduction

The typhlocybinae genus *Dayus* was established by Mahmood in 1967 with *D. elongatus* as the type species from Singapore. Dworakowska (1971) added three more species, *D. takagii* Dworakowska, *D. upoluanus* (Osborn, 1934) and *D. euryphaessus* (Kirkaldy, 1907) and Dworakowska & Viraktamath (1978) added a new species, *D. formosus* from India and China (Taiwan). Five species of the genus have been reported worldwide, distributed throughout the Austro-Oriental Region. Here we review the species of *Dayus* known to occur in China, including two previously described and three new species.

Material and methods

Except for the nomenclature of the wing, for which we follow Dworakowska (1993), the methods and terminology used in this work follow Zhang (1990). The specimens used in this study are deposited in the Entomological Museum, Northwest A & F University, Yangling, Shaanxi, China (NWAUFU) and China Agricultural University (CAU).

Results

Genus *Dayus* Mahmood

Dayus Mahmood, 1967: 39.

Type species: *Dayus elongatus* Mahmood, 1967, by original designation.

Mostly red and fragile species. Anterior margin of crown roundly protuberant and continuous with outer margin of eyes, posterior margin slightly concave, middle length of vertex equal to width between eyes. Coronal suture short and distinct. Face with anteclypeal and frontoclypeal areas swollen. Pronotum large. Scutototocutellar sulcus distinct. Forewing with apical cells occupying less than one-third its length, 2nd apical cell slightly broadening towards apex, 4th apical cell shortest; c and r cells equal in width, narrower than m and cua cells; veins RP, MP' and MP''+CuA' arise from m cell. Hind wing with broad apical m cell and an area bordered by re-emerging AA and AP' veins, small; CuA unbranched apically.

Abdominal apodemes well developed, divergent posteriorly. Pygofer elongate, strongly narrowing caudad, with rigid macrosetae on each side of pygofer lobe; dorsal margin produced with a rounded lobe-like structure usually with one or two rigid microsetae; ventral appendage present. Subgenital plate far exceeding pygofer side, broad at base, with macrosetae in basal group and laterally in one or two rows near middle portion. Paramere serrate apically, preceded by setae and sensory pits. Connective completely fused with the base of aedeagus. Aedeagal shaft compressed, gonopore apical, small; without preatrium and dorsal apodeme. Anal tube process broad, curved and narrowing apically with subapical ligament connection from dorsal margin.

Discussion. *Dayus* is related to *Ifugoa* Dworakowska & Pawar, *Usharia* Dworakowska, *Baguoidea* Mahmood and *Goifa* Dworakowska by the posteriorly divergent abdominal apodemes; and connective fused with the base of the aedeagus. It differs from *Ifugoa* & *Usharia* by the forewing veins RP, MP' and MP''+CuA' all arising from the m cell and the subgenital plate with macrosetae in a basal group. From *Baguoidea* it differs in having the subgenital plate with a row of macrosetae subapically rather than a cluster of macrosetae and from *Goifa* by the pronotum being longer than the crown, the c and r cells of the forewing equally wide and the subgenital plate with macrosetae in a basal group, with macrosetae rather than fine microsetae laterally, and the inner margin without small fine setae.

Mahmood (1967) in his original description of the genus states that "This genus has characters in common with *Empoasca* but differs in the absence of an anal hook." However, based on examination of the specimens of *Dayus* deposited in NWAUFU and in CAU; and the illustrations of *Dayus* species described by Dworakowska (1971) and Dworakowska & Viraktamath (1978), all species have anal tube process. A similar situation occurs in the genus *Homa* Distant redescribed by Mahmood (1967); this genus also has anal tube process.

Dworakowska (1971) transferred *Homa upoluana* Osborn (1934), described from Samoa, to *Dayus* as a new combination based on the original description. The male genitalia of this species have not been examined or illustrated, but this species differs from those included here in coloration (ivory white in *D. upoluana*, red in the Chinese species), the body length (1.75 mm in *D. upoluana*, 3.0–4.2 mm in males of the Chinese species), and the vertex length (in *D. upoluana* longer than the pronotum, shorter than the pronotum in the Chinese species).

Key to the Chinese species of the genus *Dayus* Mahmood (males)

1. Subgenital plate with 9 apically rounded setae in basal group (Fig.9); male pygofer ventral appendage forked apically (Fig. 11); aedeagal shaft with subapical processes forked (Fig. 6) *D. lii* n. sp.
Subgenital plate with 3–6 acute setae in basal group (Figs 19, 28, 37); male pygofer ventral appendage and subapical processes of aedeagal shaft not forked (Figs 21, 17, 30, 25, 39, 34) 2
2. Aedeagal shaft with one pair of processes 3
Aedeagal shaft with two pairs of processes 4
3. Subgenital plate with 6 setae in basal group. Aedeagal shaft expanded and membraneous apically, processes long and arising near midlength of shaft *D. membranaceus* n. sp.
Subgenital plate with 3 setae in basal group. Aedeagal shaft not expanded and membraneous apically, processes short and arising apically *D. formosus*

4. Apical processes of aedeagal shaft not recurved, with small denticles basally (Fig. 26).....*D. lamellatus* **n. sp.**
*D. takagii*
 Apical processes recurved, smooth without small denticles basally (Fig. 35).....

***Dayus lii* n. sp.**

(Figs. 1–12)

Type material. Holotype, male (CAU): Dazhulan, Jianyang, Fujian Province, 27 Oct. 1974, coll. Fasheng Li.
 Length. Male 4.2 mm.

Ground colour of body red. Vertex with irregular sordid yellow patch bordering eye; with a longitudinal greyish patch along coronal suture. Eyes grayish-black except median part dark. Apical 1/3 of fore wing semi-transparent, light testaceous, hind wing with veins R, MP and CuA reddish. Legs red except hind tibia reddish beige and tarsi yellowish.

Abdominal apodemes reaching to middle of segment V. Male pygofer abruptly narrowing apically, with about 10 linearly rigid setae on each side of pygofer lobe, with more posterior setae longer; dorsal lobe-like structure with a rigid microseta; ventral pygofer appendage branched apically, dorsal branch shorter than ventral one. Subgenital plate wide at base, nearly parallel-sided from basal 2/5 to sub-apex, with 9 apically rounded macrosetae in basal group, 28–30 marginal microsetae, 14 lateral macrosetae and 2–4 rows of fine microsetae. Parameres sinuate, apex bearing 8 teeth preceded by about 9 setae. Aedeagal shaft with a bifurcate subapical process and a short apical process on each side. Anal tube process narrowing in apical part.

Female. Unknown.

Etymology. This species is named after the collector of the holotype, Mr. Fasheng Li.

Discussion. *Dayus lii* **n. sp.** is similar to *Dayus takagii*. It differs from the latter in its longer body length in male (4.2 mm compared to 3–3.1 mm), ventral pygofer appendage branched subapically, subgenital plate with 9 setae in basal group, nearly parallel-sided over its most part and aedeagal shaft with a pair of subapical bifurcate processes and another shorter pair of apical processes.

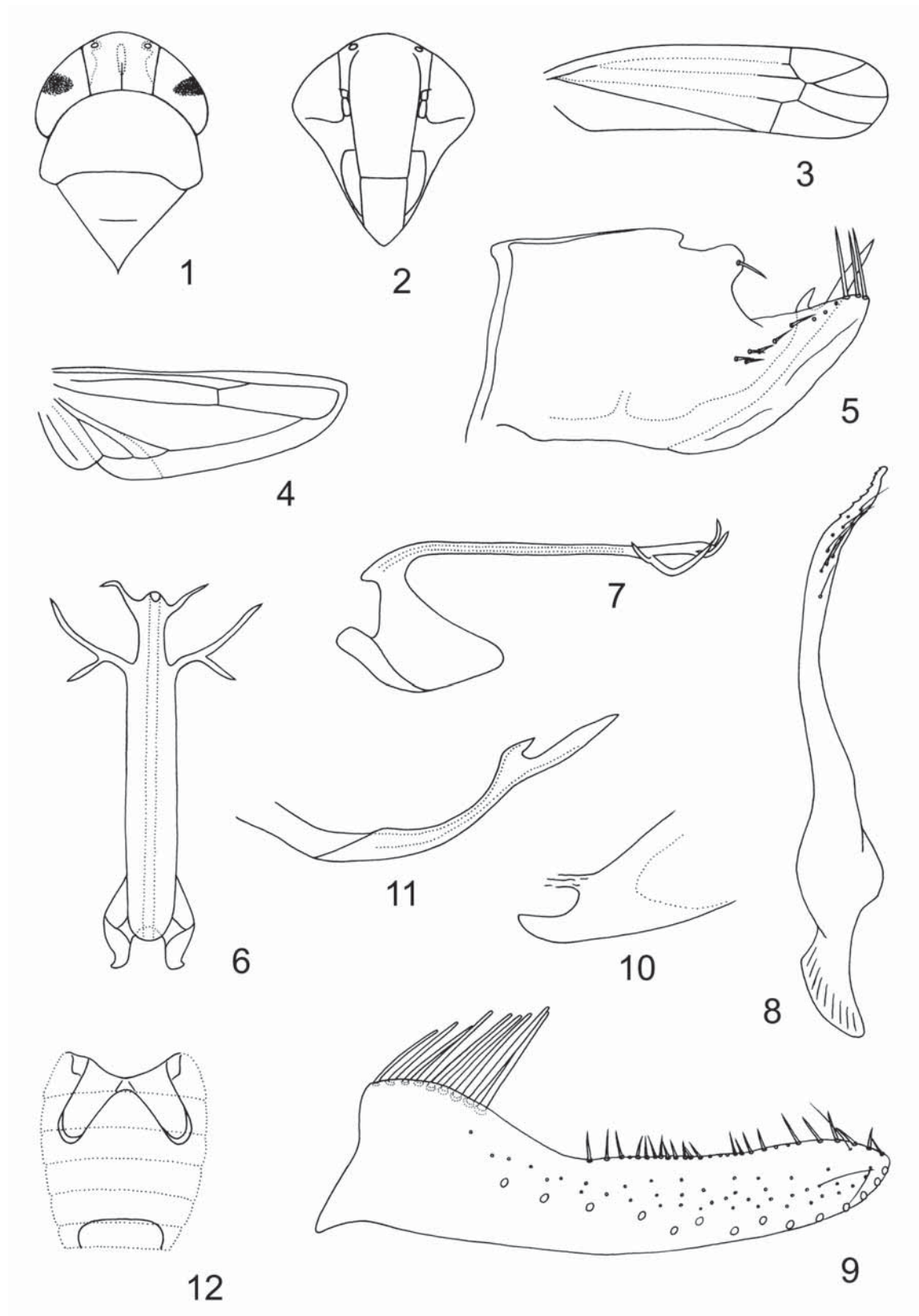
***Dayus membranaceus* n.sp.**

(Figs. 13–21)

Type material. Holotype, male (NWAUFU): Guilin, Shaowu, Fujian Province, 14 Jul. 1963, coll. Yao Zhou.
 Length. Male 3.5 mm.

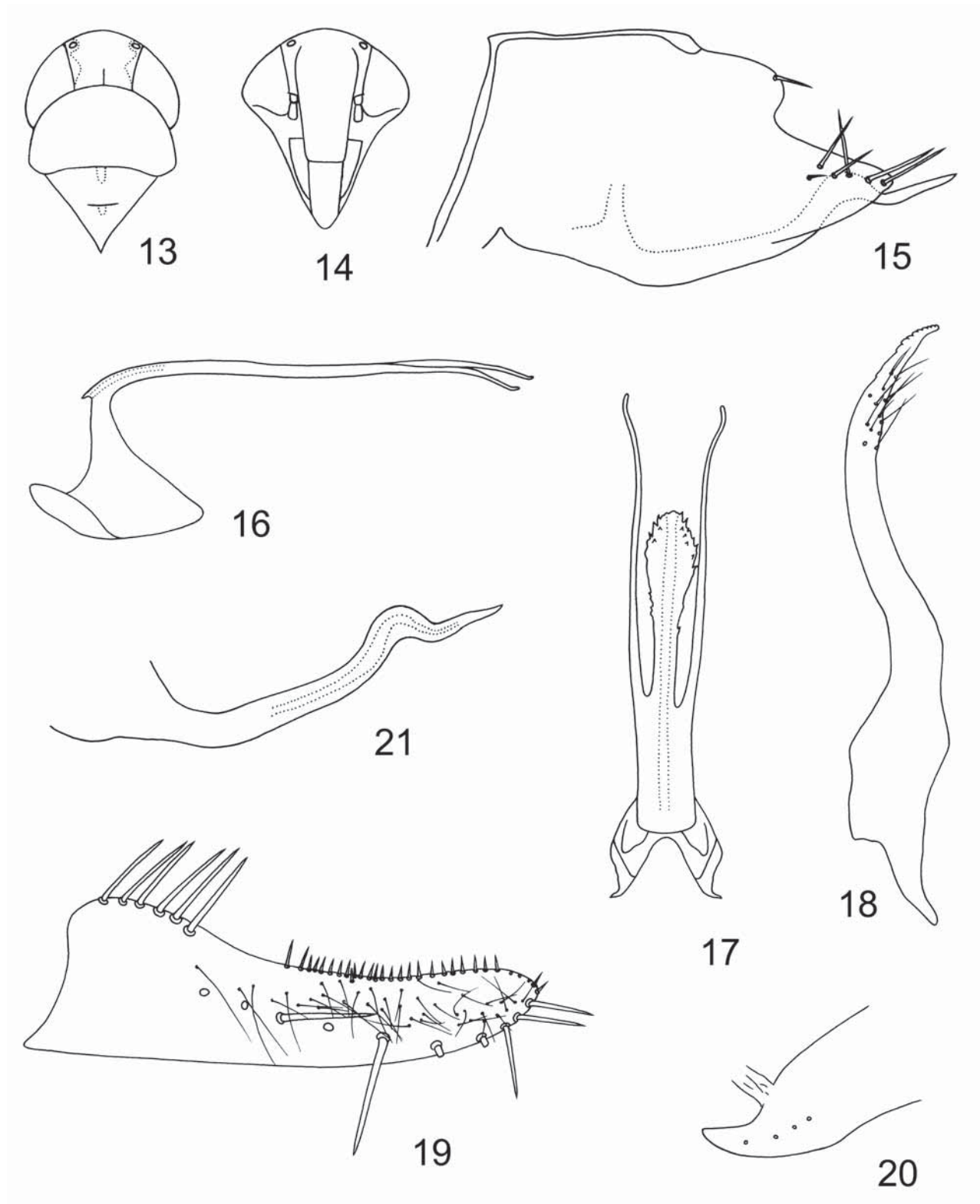
Ground colour of body red. Vertex with a beige irregular patch bordering eye. Eyes greyish-black. Scutellum medially with a small yellowish patch at anterior margin. Scutoscuteellar sulcus dark red, below with a small yellowish patch. Apical part of forewing semitransparent, light testaceous. Abdominal sternites with a yellowish transverse fascia anteriorly and posteriorly reddish orange centrally; a small yellowish patch laterally on each of segments 3–8. Legs red except first and apical half of third tibia, sordid red and third tarsi sordid yellow.

Male pygofer elongate, apical half narrowing caudally in lateral view, with 6 rigid setae at apex of pygofer lobe with more posterior setae longer; lobe-like structure of dorsal margin with a rigid seta; ventral pygofer appendage long, subapex arched distally and slightly expanded, distally very slightly sinuate with pointed apex. Subgenital plate broadest at base, gradually tapering towards apex, with 6–7 macrosetae in basal group, 29–30 spine-like setae laterally, 11 uniseriate macrosetae, and several elongate fine setae starting caudad of, and similar in length to, basal macrosetae. Parameres broad, sinuate, apex bearing more than 10 denticles,



FIGURES 1–12. *Dayus lili* n. sp., 1, head and thorax, dorsal view; 2, face; 3, fore wing; 4, hind wing; 5, pygofer, lateral view; 6, aedeagus and connective, dorsal view; 7, same, lateral view; 8, paramere; 9, subgenital plate; 10, anal tube process; 11, ventral pygofer appendage; 12, abdominal apodeme.

more compact apically and preceded by about 9 setae. Aedeagal shaft broader in basal half in dorsal view with a process arising medially at each side, far surpassing tip of shaft, apex of shaft membranous, expanded, surface with teeth. Anal tube process broad, tapering and curved apically.



FIGURES 13–21. *Dayus membranaceus* n. sp., 13, head and thorax, dorsal view; 14, face; 15, pygofer, lateral view; 16, aedeagus and connective, lateral view; 17, same, dorsal view; 18, paramere; 19, subgenital plate; 20, anal tube process; 21, ventral pygofer appendage.

Etymology. The specific name is derived from the Latin word membranaceus which refers to the membranous aedeagal apex in this species.

Female. Unknown.

Discussion. This species is similar to *D. formosus* and *D. elongatus*. It differs from these species by its arched and subapically slightly expanded ventral pygofer appendage; subgenital plate with 6–7 setae in basal group; aedeagal shaft broad in basal half, with a process arising medially at each side, far surpassing the tip of shaft; and tip of shaft membranous, expanded, with surface denticles. It also differs from *D. elongatus* in lacking the apical lobe of the subgenital plate.

***Dayus lamellatus* n.sp.**

(Figs. 22–31)

Type materials. Holotype, male (CAU): Gushan, Fuzhou, Fujian Province, 21 Nov. 1974, coll. Chi-kun Yang; Paratypes, 1 female (CAU), Gushan, Fuzhou, Fujian Province, 20 Oct. 1974; 1 female (CAU), Aotou, Jianyang, Fujian Province, 28 Oct. 1974, coll. Chi-kun Yang.

Length. Male 3.2 mm, female 3.0–3.2 mm.

Ground colour of body red to carmine. Vertex with a small yellowish patch bordering eye. Face red to reddish orange, anteocular areas with a yellowish patch. Apical 1/3 of forewing semitransparent, veins reddish, veins of hind wing red to reddish orange. Abdomen red dorsally, sternites laterally with large yellowish patch and a more posterior small yellowish patch on each of segments 3–8. Legs yellowish with fore femur and tibia and most part of third tibia, reddish-orange. Female valvula red.

Abdominal apodemes reaching end of segment 4. Male pygofer strongly narrowed in apical half, with 10–11 rigid setae on pygofer lobe with more distal setae longer, lobe-like structure of dorsal margin with 2 spine-like setae; ventral pygofer appendage arising from near middle of ventral margin, sinuate and broad medially. Subgenital plate broadest at base, gradually tapering to apex, with 3 macrosetae in basal group, about 15 marginal spine-like setae laterally, and 11–13 uniseriate macrosetae, starting caudad of, and similar in length to, basal group setae. Paramere broad at base, sinuate, apex bearing more than 10 denticles preceded by about 4 setae. Aedeagal shaft with pair of leaf-like process subapically and pair of short apical processes, more or less straight, dentate basally at outer margins. Anal tube process broad at base, tapering and curved apically.

Etymology. The name is derived from the Latin word lamellatus (leaf-like), which refers to the shape of the subapical aedeagal processes.

Female. Unknown.

Discussion. *Dayus lamellatus* n. sp. is similar to *D. takagii* but it differs from the latter in having the subapical processes of the shaft leaf-like and more laterally curved, and the apical processes shorter and straighter in dorsal view with small teeth at the outer margins basally.

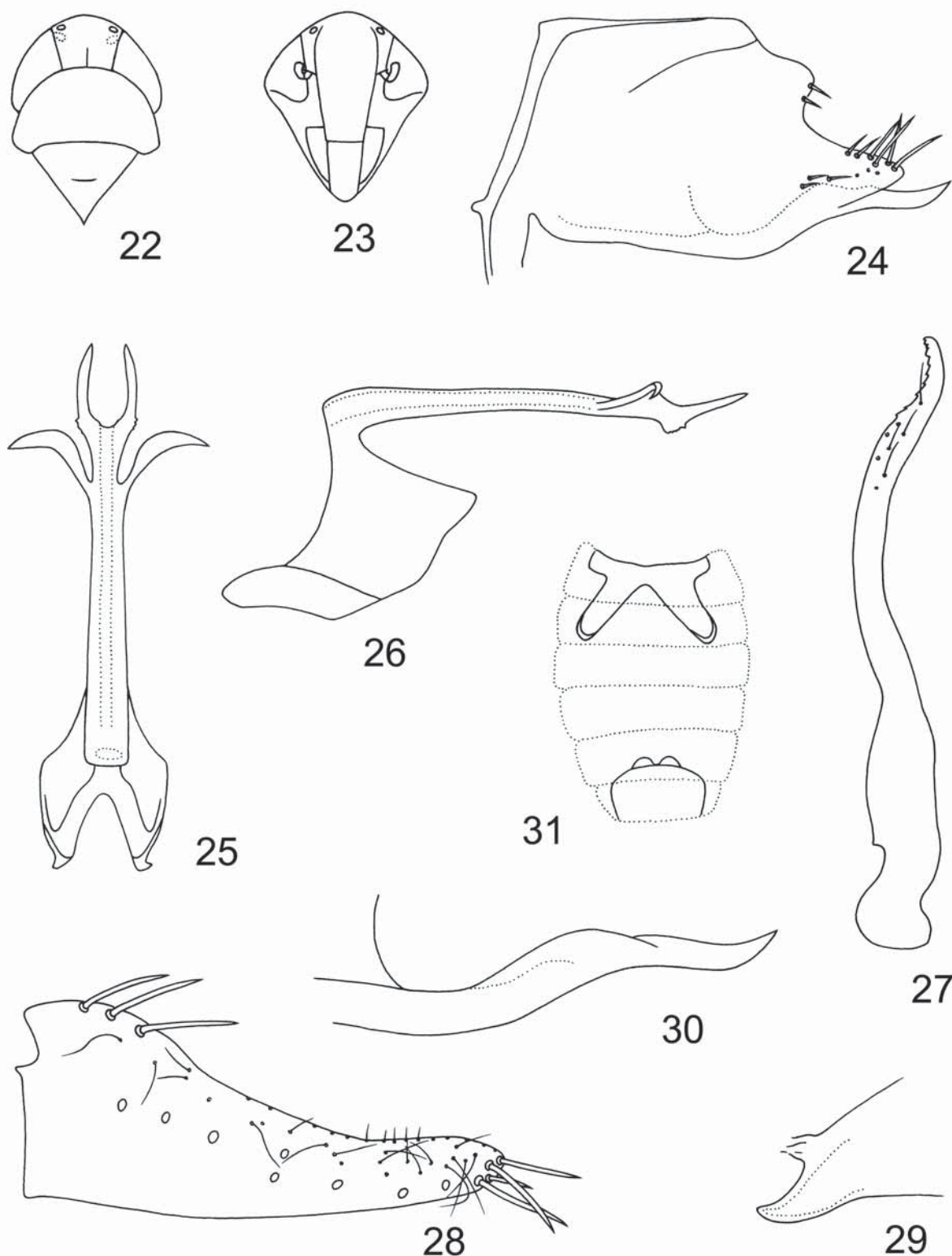
***Dayus takagii* Dworakowska, 1971**

(Figs. 32–40)

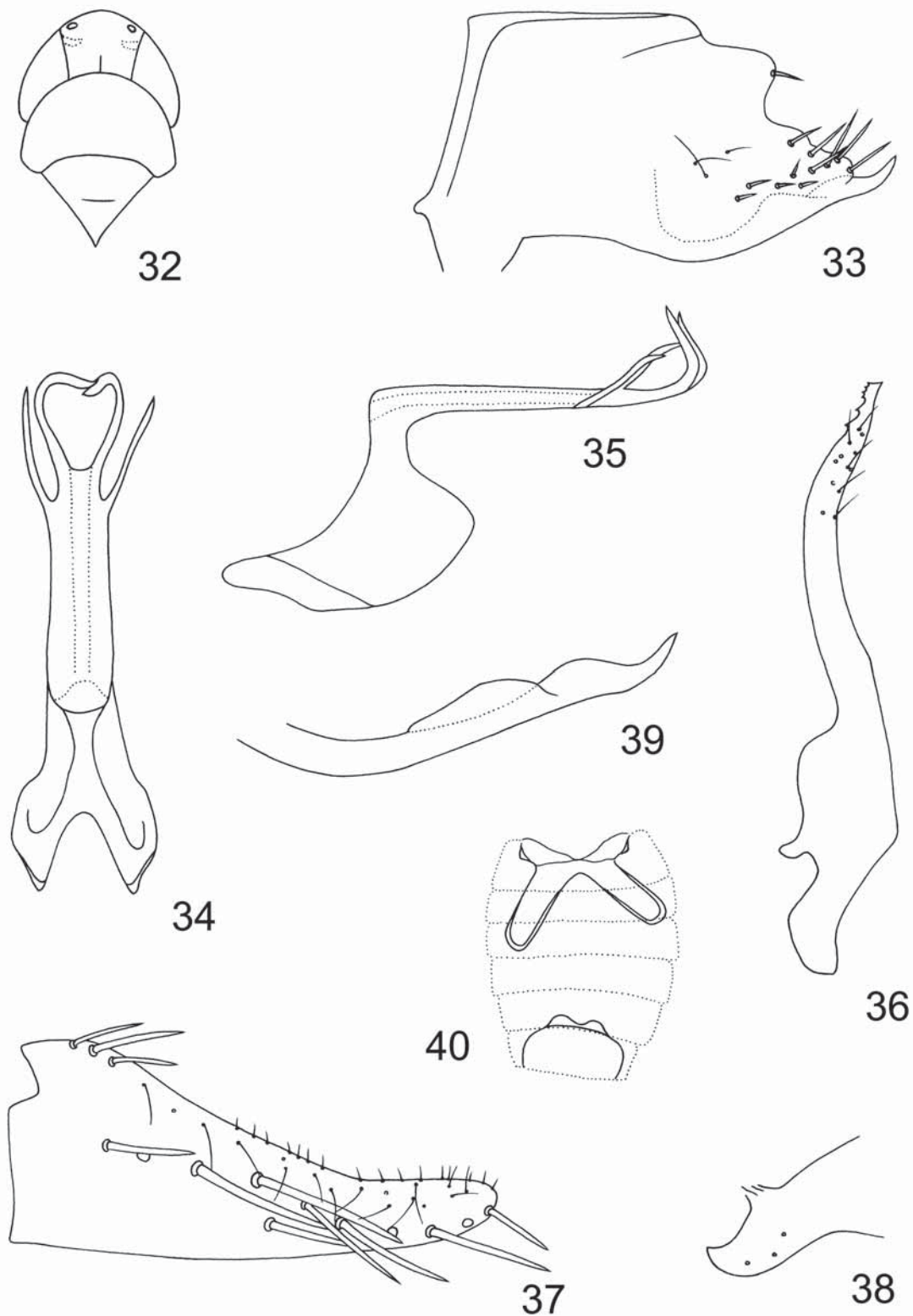
Dayus takagii Dworakowska, 1971: 501

Specimens examined: 1male, Wannian temple, Emei mountain, Sichuan Province, 11 Sept. 1986, Shuling Zheng, Qiuyuan Xu and Jingruo Zhou.

Distribution: China (Sichuan and Taiwan Provinces), Japan.



FIGURES 22–31. *Dayus lamellatus* n. sp., 22, head and thorax, dorsal view; 23, face; 24, pygofer, lateral view; 25, aedeagus and connective, dorsal view; 26, same, lateral view; 27, paramere; 28, subgenital plate; 29, anal tube process; 30, ventral pygofer appendage; 31, abdominal apodeme.



FIGURES 32–40. *Dayus takagii* Dworakowska, 32, head and thorax, dorsal view; 33, pygofer, lateral view; 34, aedeagus and connective, dorsal view; 35, same, lateral view; 36, paramere; 37, subgenital plate; 38, anal tube process; 39, ventral pygofer appendage; 40, abdominal apodeme.

***Dayus formosus* Dworakowska & Viraktamath, 1978**

Dayus formosus Dworakowska & Viraktamath, 1978: 544.

Specimens examined: 1male 4 females, Qiongzong, Hainan Province, 5 Jun. 1983; 5 females, 1 Jun. 1983; 1 female, 15 Jun. 1983, Liangyuan, Hainan Province, coll. Yalin Zhang.

Distribution: China (Hainan and Taiwan Provinces), India.

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